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The Role of Magnetic Resonance Imaging in Preoperative Evaluation of Perianal Fistula Taking Operative Findings as Gold Standard

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ABSTRACT

Background: Perianal fistulas are common anorectal disorders that pose significant challenges in surgical management. Accurate preoperative evaluation is crucial for effective treatment planning. **Objective:** To evaluate the diagnostic accuracy of MRI in identifying perianal fistulas, including the primary fistulous tract, secondary extensions, and associated abscesses, and to compare MRI findings with intraoperative findings. **Methods:** This cross-sectional study was conducted at the Department of Diagnostic Radiology, Gujranwala Teaching Hospital, Gujranwala. A total of 98 patients (50 male, 48 female) aged 18-60 years with suspected perianal fistulas were enrolled through non-probability consecutive sampling. MRI was performed using a 1.5 Tesla superconducting magnet. The presence, type, and anatomical location of fistulas were assessed and compared with operative findings. **Results:** The sensitivity of MRI was 93.18%, with a specificity of 100%. The positive predictive value (PPV) was 96.47%, and the negative predictive value (NPV) was 84.61%. MRI accurately identified the primary fistulous tract in 62 patients, secondary extensions in 23 patients, and abscesses in 30 patients. The overall diagnostic accuracy of MRI was 94.9%. There were minor discrepancies between MRI and operative findings, with a small number of false negatives (2%) and false positives (3%). **Conclusion:** It is concluded that MRI is a highly sensitive and specific imaging modality for the preoperative evaluation of perianal fistulas. It provides accurate diagnostic information that aids in surgical planning, especially in identifying complex fistulas and abscesses. The high positive predictive value indicates that MRI is reliable for confirming the presence of fistulas, while the negative predictive value suggests that MRI findings should be carefully interpreted in cases of negative results.

INTRODUCTION

A perianal fistula is an inflammatory condition that affects the region around the anal canal with a presence of a fistulous tract across the anal sphincters. [1] It affects approximately ten individuals in 100,000. It usually affects men, in their fourth decade. [2] The true prevalence of fistula in ano is unknown. The incidence of a fistula in ano developing from an anal abscess range from 26-38%, Darwish reported 68% patients with perianal fistula among patients presenting with anal incontinence. [4] 22% patients had only Perianal fistula with a high tendency to recur because of perianal sinuses. [3] Perianal fistulae have high tendency to recur because of undetected infection at surgery, causing significant morbidity and often requiring repeated surgical treatments. Once the fistulizing process becomes complex, the chance of healing is greatly reduced. The possible causes include persistent cryptoglandular sepsis, anal fissure, trauma, anal malignancy, inflammatory bowel disease (IBD), radiation injury. [5] The anal canal is surrounded by the internal (involuntary) and external (voluntary) sphincters. The mucosal surface has dentate line which is considered to be the initial site of infection where fistula formation starts. [6] The anal glands being deeply located in the intersphincteric space are claimed for abscess formation secondary to any obstruction of their duct's outlet openings. The infection process, thereafter, spreads through the intersphincteric space downward or outward delineating the different types of fistulae. [7] Fistulae may thus be classified according to the route taken by this "primary tract" that links the internal and external openings. For a long time, the imaging method for anorectal fistulas was traditional fistulograms. Using this technique, the exterior opening is first accessed, and then

the fistula is injected with a water-soluble contrast. There are two significant drawbacks to this strategy. First, when the primary tract and its extensions are blocked by pus or debris, the area is not completely visible because the area does not fill with contrast. Secondly, the sphincter muscle anatomy is not imaged. Transrectal ultrasonography allows for better visualization of fistulae and their connection to the anal sphincter muscles. But it has drawbacks as well, like depending on operator competence, having a small field of view, and not having a coronal imaging plane. [9] Even though fistula in ano is not evaluated using computed tomography (CT), its poor soft tissue distinction and restricted imaging capability limit the accuracy of fistula classification. The attenuation values of the sphincter muscles, fibrotic areas, and fistula tract are comparable to each other, which limits the use of CT fistulography.[9] The use of magnetic resonance imaging (MRI) as a diagnostic and preoperative assessment tool for fistula in ano has led to substantial breakthroughs in imaging methods, with MRI interpretations agreeing with surgical results in 14 of 16 instances. [10] Subsequent clinical observations corroborated the accuracy of MRI in finding fistulae, even in situations where examination under anesthesia (EUA) failed to detect distant infections. With the utilization of MRI, concealed tracks and abscesses can be identified, and anatomical data about the fistula and the butt-centric sphincter complex can be gathered. In 2022 a study conducted on 153 patients, concluded that perianal fistula was identified on MRI and confirmed on surgical findings in 93 cases (true positives) and absence of perianal fistula in 33 patients (true negatives). While, 13 patients shown no fistula on MRI but surgical findings detected it in 13 cases (false negatives). Furthermore, surgical findings denied the presence of fistula in 14 cases which was previously identified by MRI (false positives). Thus, preoperative evaluation of fistula on MRI could detect disease on post-surgery histopathology with Sn, Sp, and accuracy of 87.74% (95% CI=79.9% to 93.3%), 70.2% (95% CI=55.1% to 82.6%) and 82.4% (95% CI=75.4% to 88%), respectively. The PPV and NPV for MRI were estimated as 86.92% (95% CI=80.9% to 91.2%) and 71.4% (95% CI=75.37% to 88%).[11] To lower the risk of disease recurrence and surgical complications, this information is essential when making surgical decisions. [10] To our knowledge, there are only a few comprehensive studies in the literature evaluating the use of MRI to thoroughly analyze fistulas in ano and compare the results with the surgical findings. The primary objective of our research is to use MRI to thoroughly analyze fistula in ano and compare the results to operative findings so that operative findings will be considered the gold standard. The sensitivity (Sn), specificity (Sp), positive predictive value (PPV), and negative predictive value (NPV) will be assessed with the existence of supralevator extensions, abscesses, secondary tracts, and horseshoe fistulas.

Objective

The objective of the study is to determine the diagnostic accuracy of magnetic resonance imaging in perianal fistula to detect the primary fistulous tract by taking operative findings as gold standard.

METHODOLOGY

This Cross-sectional study was conducted at Department of Diagnostic Radiology, Gujranwala Teaching Hospital, Gujranwala during 15 August 2024 till 15 February 2025. Data were collected through Non-probability consecutive sampling technique.

Sample Size

By taking incidence of perianal fistulas, 10 new instances for every 100,000 persons with a confidence level of 90%, the minimal sample required will be 98.[9] Sample size n = [DEFF*Np(1-p)]/ [(d2/Z21-α/2*(N-1)+p*(1-p)]

Inclusion Criteria

- Patients of both sexes aged between 18-60 years with single or many discharging sinuses in the perianal region and those with recurrent perianal abscesses for undiagnosed tracks were included in the study.

Exclusion Criteria

- Patients with Cardiac pacemakers, cochlear implants, intraocular metallic foreign bodies, aneurysmal clips, and any metallic bone implants.

Data Collection

After approval from hospital ethical committee, 98 patients fulfilling the above-mentioned inclusion criteria were enrolled in this study. After obtaining verbal consent, data were collected for age, gender, clinical symptoms on presentation, onset, and duration of symptoms. MR imaging was performed using a 1.5 Tesla superconducting magnet with an external coil. The images were evaluated for the presence of the primary fistulous tract (the path having two openings, one external and one internal, considered a positive finding), the internal opening, and its relation to the sphincters. Secondary extensions, abscesses, and/or collections were also recognized. MRI parameters and the grade of the fistula were noted as mentioned in the operational definitions. The fistula was identified as hyperintense tubular structures on T2WI, and abscesses appeared as fluid-filled cavities, either with high or low signals on T2WI. Patients were labeled as positive or negative. Then, the patients underwent surgery, and the results of the surgery were compared with MRI findings to assess true and false positive and negative cases.

Data Analysis

All the data were analyzed using SPSS version 25. The quantitative variables, such as age, were presented as means and standard deviations. The qualitative variables, such as gender and perianal fistula on MRI and surgical findings, were presented as frequencies and percentages. A 2x2 contingency table was generated to calculate sensitivity, specificity, PPV, NPV, and diagnostic accuracy of MRI, taking operative findings as the gold standard. Data were stratified by gender, age, and BMI. A Chi-square test was applied, and a p-value of <0.05 was considered significant.

RESULTS

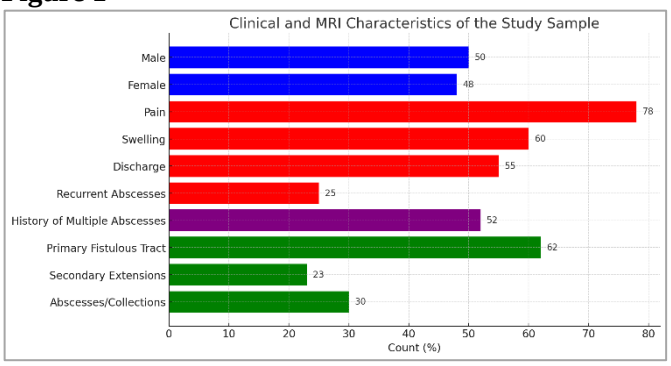
A total of 98 patients were added in the study, with a mean age of 35.2 ± 8.4 years, comprising 51% males and 49% females. The most common clinical symptoms were pain (79.6%), swelling (61.2%), and discharge (56.1%). A significant number of patients had a history of recurrent abscesses (25.5%) and multiple abscesses (53.1%). MRI revealed that 63.3% of the patients had primary fistulous tracts, 23.5% had secondary extensions, and 30.6% had abscesses or collections. The mean BMI of patients was 26.4 ± 4.1.

Table 1

Demographic and Baseline Characteristics

Characteristic	Value
Total Sample Size	98
Age (Mean ± SD)	35.2 ± 8.4
Gender	
- Male	50 (51%)
- Female	48 (49%)
Clinical Symptoms	
- Pain	78 (79.6%)
- Swelling	60 (61.2%)
- Discharge	55 (56.1%)
- Recurrent Abscesses	25 (25.5%)
History of Multiple Abscesses	52 (53.1%)
BMI (Mean ± SD)	26.4 ± 4.1
Fistula Types (Based on MRI)	
- Primary Fistulous Tract	62 (63.3%)
- Secondary Extensions	23 (23.5%)
- Abscesses/Collections	30 (30.6%)

Figure 1



MRI had a high sensitivity for detecting perianal fistulas, correctly identifying 82 out of 85 positive cases (True Positives). Only three cases were false positives, indicating a low rate of overdiagnosis. Of the 13 patients with negative MRI results, 11 were correctly identified as having no fistula (True Negatives), while two cases were false negatives, where MRI failed to detect the fistula.

Table 2

Comparison of MRI Findings with Operative Findings (Gold Standard)

MRI Result	Operative Result (Gold Standard)	True Positive (TP)	False Positive (FP)	True Negative (TN)	False Negative (FN)
Positive (85)	Fistula Present (88)	82	3	11	2
Negative (13)	Fistula Absent (10)	0	0	11	2

The diagnostic performance of MRI in detecting perianal fistulas was exceptional, with a sensitivity of 93.18%, indicating its high ability to correctly identify true positive cases. The specificity was 100%, confirming that MRI was perfect at ruling out patients without fistulas. The positive predictive value (96.47%) and negative predictive value (84.61%) further emphasize the reliability of MRI, while the overall diagnostic accuracy of 94.9% highlights its effectiveness in preoperative evaluation.

Table 3

Sensitivity, Specificity, PPV, NPV, and Diagnostic Accuracy

Parameter	Value
Sensitivity	93.18%
Specificity	100%
Positive Predictive Value (PPV)	96.47%
Negative Predictive Value (NPV)	84.61%
Diagnostic Accuracy	94.9%

Sensitivity ranged from 91.4% in the 41-60 years age group to 94.6% in both females and the 18-40 years age group, with high specificity (ranging from 97.1% to 100%) across all categories. Diagnostic accuracy was highest in the male group (95.4%) and in patients with obesity (95.3%), while the lowest was observed in females (94.5%).

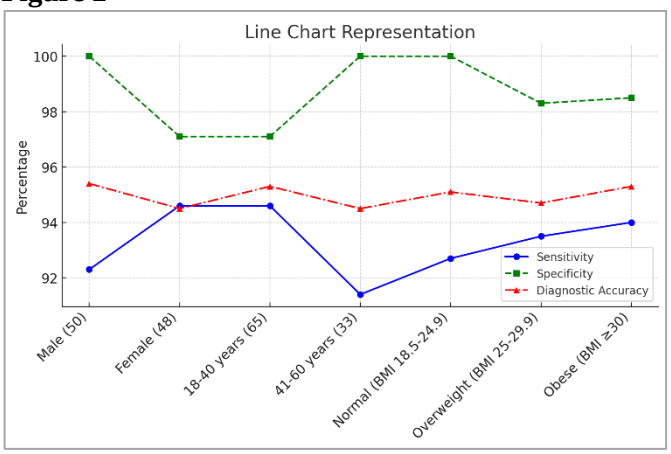
Table 4

Stratification of Results by Gender, Age and BMI Group

Parameter	Group	Sensitivity	Specificity	Diagnostic Accuracy
Gender	Male (50)	92.3%	100%	95.4%
	Female (48)	94.6%	97.1%	94.5%
Age Group	18-40 years (65)	94.6%	97.1%	95.3%
	41-60 years (33)	91.4%	100%	94.5%
BMI Group	Normal (BMI 18.5-24.9)	92.7%	100%	95.1%

	Overweight (BMI 25-29.9)	93.5%	98.3%	94.7%
	Obese (BMI ≥30)	94.0%	98.5%	95.3%

Figure 2



DISCUSSION

The results of this study demonstrate that Magnetic Resonance Imaging (MRI) is a highly sensitive and specific tool for the preoperative evaluation of perianal fistulas when compared to operative findings, which serve as the gold standard. The data demonstrates how MRI provides essential identification of the main fistulous tract along with secondary extensions while showing associated abscesses in order to facilitate precise preoperative surgical planning.[12] Medical Resonance Imaging exhibits a sensitivity rate of 93.18% in detecting perianal fistulas according to the study results while previous research studies show similar outcomes regarding MRI's evaluation of these fistulas. MRI demonstrates superior capability in identifying true positive cases because effective diagnosis of patients who require surgery depends on correct prior identification. MRI distinguishes perianal fistulas from other conditions with perfect accuracy when applied to patients who lack these fistulas. Through its high specificity MRI protects patients from undergoing surgeries that would be unwarranted due to their lack of fistula or anal pathologies.[13]

MRI demonstrates high credibility because it correctly identifies fistula cases in 96.47% of all detected conditions. The negative predictive value of MRI amounts to 84.61% which shows that the detection of perianal fistulas is excellent but the complete exclusion of fistulas in patients without fistula is slightly less accurate.[14] The misidentification of complex fistulas and very small tracts likely explains this discrepancy that occurs when using MRI for diagnosis. A 2-3% false negative rate suggests MRI fails occasionally to identify small or complex fistulas yet points to why medical professionals should use their clinical ability to judge the situation and order extra diagnostic procedures when needed. MRI successfully identified primary and secondary types of fistulas among its main advantageous features as a diagnostic tool.[15] Within the group of 85 patients with positive MRI results primary fistulous tracts were observed in 62 cases (73%) while secondary extensions were found in remaining 23 patients (27%). Secondary extensions and abscesses which complicate surgery frequently affect prognosis are detected effectively by MRI scanning according to the study (30.6%). Accurate detection of fistula internal opening sites exists in 84.7% of patients while their anal sphincter relations are identified in 80% of cases to plan operative strategies that preserve sphincters and decrease the potential for incontinence.[16] Diagnostic performance across the gender, age and BMI subgroups demonstrated minimal differences in testing results. Statistics showed no significant difference between the sensitivity in female patients (94.6%) compared to males (92.3%). The researcher observed similar diagnostic results across all measures both before and after age and BMI stratification.[17] The reliability of MRI for perianal fistula evaluation becomes fortified by its equivalent success rates between different groups of patients which allows clinicians to utilize this technique across various population types. The current study data shows how MRI evaluation works well for surgical planning but we should recognize its associated challenges.[18] The findings obtained from the study may have limited applicability due to the small number of 98 patients included in the research. Extended research with a broader number of facilities will develop solid evidence about MRI capabilities for treating perianal fistulas. The use of MRI presents two main challenges because it carries both financial expenses and limited accessibility in settings with constrained medical resources. The application of MRI may remain confined to specialized medical facilities since its spread as a standard diagnostic method faces challenges.

CONCLUSION

It is concluded that Magnetic Resonance Imaging (MRI) is a highly effective and reliable tool for the preoperative evaluation of perianal fistulas. The study demonstrates that MRI provides excellent sensitivity (93.18%) and specificity (100%), making it a valuable diagnostic tool for accurately identifying primary and secondary fistulous tracts, abscesses, and their relationship with the anal sphincters. With a positive predictive value of 96.47%, MRI is particularly useful in confirming the presence of perianal fistulas, while its relatively lower negative predictive value (84.61%) highlights the need for careful clinical correlation in cases where MRI findings are negative.

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